

REMARKS

At the outset, the Examiner is thanked for the thorough review and consideration of the pending application. The Office Action dated November 9, 2009 has been received and its contents carefully reviewed.

Claim 1 is hereby amended. Support for the amendment can be found, for example, at Specification, page 7, line 2, to page 8, line 6. No new matter has been added. Accordingly, claims 1-9 and 11 are currently pending. Reexamination and reconsideration of the pending claims are respectfully requested.

The Office Action rejects claims 1-2, 5-7, and 11 under 35 U.S.C. §103(a) as being obvious over “Nanofabrication of Organic/Inorganic Hybrids of TiO₂ with Substituted Phthalocyanine or Polythiphene” to Ding (*Ding*) in view of “Polymer brushes: surface-immobilized macromolecules” to Zhao (*Zhao*). Applicants respectfully traverse the rejection.

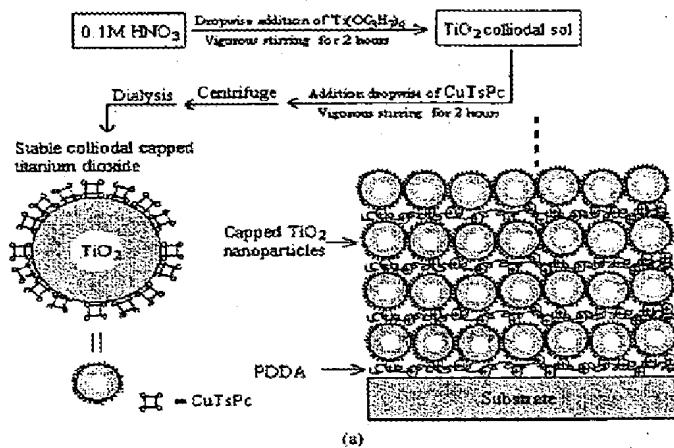
In order to establish *prima facie* obviousness of the claimed invention, all the elements must be taught or suggested by the prior art. The combined teachings of *Ding* and *Zhao* fail to teach each and every element of claims 1-2, 5-7 and 11, and thus, cannot render these claims obvious.

Claim 1 recites, “a step in which said substrate is functionalized by chemical grafting of one or more compounds containing at least one group that can be polymerized with one or more precursors of an electrically conducting polymer and at least one group able to be chemically grafted onto said substrate, the one or more compounds are brought into contact with the substrate to obtain, and the one or more compounds are grafted to said substrate ... a step in which said precursor or precursors are polymerized to obtain polymers grafted to said substrate through the one or more compounds grafted to said substrate, wherein the n-type region of the pn-semiconductor material consists of said substrate and the p-type region of the pn-semiconductor material consists of the polymers grafted to said substrate, or conversely.” The present application further explains that the present invention provides “a pn-type semiconductor material which is free of the above-mentioned drawbacks, especially in that there is strong interaction between the p-semiconductor region and the n-semiconductor region, and which, however, allows the short-circuit phenomena between these two regions to be limited.” *Specification*, page 6, lines 22-28.

Ding fails to teach or suggest the above-recited elements of claim 1. In fact, the Office Action admits that “*Ding* is silent to a step in which the substrate thus functionalized being impregnated with a solution containing the precursor(s); and a step in which the precursor(s) are polymerized.” *Office Action*, page 3. Furthermore, *Ding* does not disclose or suggest the method of preparing a pn-semiconductor material of claim 1, and does not recognize or provide a solution to the problem identified in the present invention, i.e., the problem of interpenetration of the n-region and the p-region in a pn-semiconductor material.

Zhao does not cure the deficiency of *Ding*. *Zhao* does not deal with the field of pn-semiconductor, and does not provide a solution to the problem of interpenetration of the n-semiconductor region and the p-semiconductor region. Instead, *Zhao* generally describes polymer brushes tethered by one end of a substrate and successively treated with a step of immobilizing on a substrate initiator compounds followed by *in situ* surface initiated polymerization. *Zhao* discloses a method that allows an increase in grafting density, but *Zhao* does not deal with the interpenetration of a polymer in the porosity of an oxide substrate as it is the case of the invention for the pn-semiconductor material. The grafting density of *Zhao* only concerns the grafting density of the surface of a substrate.

Moreover, the alleged combination of *Ding* and *Zhao* would yield unsatisfactory results. *Ding* presents two methods of preparation for ordered ultrathin films of substituted Pcs or PThs-sensitized TiO₂ nanoparticles. *Ding*, page 208, right column, and Figure 1(a).



Ding emphasizes that “[i]t is necessary for Pcs or PThs to be adsorbed onto the nanoparticle surface in a closely packed monolayer for maximum sensitization efficiency” and

“it is important to design the Pcs- or PThs-TiO₂ contact to improve light absorption, carrier generation, and transport properties.” *Ding*, page 207. There is no teaching or suggestion that Pcs- or PThs-sensitized TiO₂ nanoparticles could be impregnated with a solution containing precursors and the precursors are polymerized onto the nanoparticles. Importantly, if the precursors were polymerized onto the nanoparticles, the Pcs- or PThs-TiO₂ would not contact. Thus, it would destroy the intended purpose of the Pcs- or PThs-TiO₂, i.e., to improve light absorption, carrier generation, and transport properties. Because the alleged combination of *Ding* and *Zhao* would yield unsatisfactory results, one of ordinary skill in the art would not have been motivated to combine *Ding* and *Zhao*.

Accordingly, claim 1 is allowable over the combined teachings of *Ding* and *Zhao*. Claims 2, 5-7, and 11 variously depend from claim 1, and are also allowable for at least the same reasons as claim 1. Applicants, therefore, respectfully request withdrawal of the rejection of claims 1-2, 5-7, and 11.

The Office Action rejects claims 3-4 and 11 under 35 U.S.C. §103(a) as being over *Ding* and *Zhao* and further in view of “A low cost, high efficiency solar cell based on dye sensitized colloidal TiO₂ films” to O’regan (*O’regan*). Applicants respectfully traverse the rejection.

Claims 3, 4, and 11 variously depend from claim 1 and incorporate all the elements of claim 1. As discussed, the combined teaching of *Ding* and *Zhao* fails to teach or suggest at least the above-recited elements of claim 1. *O’regan* does cure the deficiency of *Ding* and *Zhao*. In fact, the Office Action only cites *O’regan* for disclosing that the nanoparticles are mesoporous. *Office Action*, page 5. Accordingly, claim 1 and its dependent claims 3, 4, and 11 are allowable over the combined teaching of *Ding*, *Zhao*, and *O’regan*. Applicants, therefore, respectfully request withdrawal of the rejection of claims 3, 4, and 11.

The application is in condition for allowance and early, favorable action is respectfully solicited. If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at (202) 496-7500 to discuss the steps necessary for placing the application in condition for allowance. All correspondence should continue to be sent to the below-listed address.

If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. §1.136, and any additional fees required under 37

C.F.R. §1.136 for any necessary extension of time, or any other fees required to complete the filing of this response, may be charged to Deposit Account No. 50-0911. Please credit any overpayment to deposit Account No. 50-0911. A duplicate copy of this sheet is enclosed.

Dated: April 8, 2010

Respectfully submitted,

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